



**CALIFORNIA
ENERGY COMMISSION**



California Energy Commission
Clean Transportation Program

FINAL PROJECT REPORT

City of San Mateo Digester Gas to Biomethane for Vehicle Fuel

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PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to \$20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about \$100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued PON-13-609 to provide funding opportunities for Pilot-Scale and Commercial Scale Advanced Biofuels Production Facilities. In response to PON-13-609, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards on July 18, 2014 and the agreement was executed as ARV-14-028 on December 9, 2014.

ABSTRACT

This report for the California Energy Commission is for the City of San Mateo's project to sustainably and cost-effectively produce low carbon vehicle fuel from the unused digester gas that is generated at the city's wastewater treatment plant. In the report are the details of the project from inception to design to construction to production as well as costs and schedules.

The concept for the project began in 2014 and construction was completed in 2016. Fuel is being produced and vehicles are being filled and powered with the compressed natural gas. The City of San Mateo is actively participating in the Federal Environmental Protection Agency's Renewable Identification Number credits and the State of California's Low Carbon Fuels Standards credits for the biomethane production.

The City of San Mateo's current challenge is locating and purchasing vehicles equipped to run on compressed natural gas. With only three vehicles in its fleet, gas consumption is only a fraction of what is available. The average usage to date is twelve gas gallon equivalents per day versus the five hundred gas gallon equivalents per day that the system can process from the available digester gas.

With the new and innovative equipment, the City of San Mateo entered into extended 5-year warranty and maintenance service agreements with the equipment manufacturers and has built into the service agreements the training for on-site City personnel. The final outcome of this project will be that the production, consumption and maintenance of the digester gas to biomethane gas will be under the direct control of the City.

Keywords: California Energy Commission, City of San Mateo, low carbon fuel, digester gas, wastewater treatment plant, Environmental Protection Agency, Renewable Identification Credits, Low Carbon Fuel Standard, biomethane production, compressed natural gas

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TABLE OF CONTENTS

	Page
Acknowledgements	i
Preface	ii
Abstract	iii
Table of Contents	v
List of Figures	vi
List of Tables	vi
Executive Summary	1
Chapter 1: Project Narrative	3
1.1 Approach	3
1.1.1 Exploring Options for Digester Gas Use	4
1.2 Sustainability	5
1.3 Business Plan	5
1.3.1 Project Funding	5
1.3.2 Revenue and Cost Savings	6
1.4 Project Implementation	6
Chapter 2: Activity Report	9
2.1 Project Schedule	9
2.2 Project Budget	9
2.3 Data Collection and Analysis	10
2.3.1 Design Data	10
2.3.2 Data Collection	12
2.3.3 Data Collection on Equipment	14
Chapter 3: Project Assessment	18
3.1 Goals	18
3.1.1 Sustainability	18
3.1.2 Carbon Credits	18
3.1.3 Construction	20
3.2 Awards	21
3.2.1 American Council of Engineering Companies California Award	21
3.2.2 American Council of Engineering Companies National Award	21
Chapter 4: Recommendations for Further Projects	23
4.1 Project Challenges	23
4.1.1 Permits	23
4.1.2 Acquisition of CNG Vehicles	23
Glossary	25

LIST OF FIGURES

	Page
Figure 1: Wastewater Treatment Plant Site Plan	3
Figure 2: Wastewater Treatment Plant Digester	4
Figure 3: City of San Mateo’s Open-Flame Flare (demolished)	5
Figure 4: City of San Mateo Organization Chart	6
Figure 5: Groundbreaking Ceremony with Project Team.....	7
Figure 6: Completed Skid with Flare and Unison Equipment	8
Figure 7: Chevy Impala with a Close-Up of the Dual Fuel Gas Nozzles	12
Figure 8: Ford F-150 Fueling.....	13
Figure 9: One-Month Trend of the Overall System – February 2017	14
Figure 10: One-Month Trend of Gas Treatment and Fueling – June 2017	15
Figure 11: Real-Time Readings of the Gas Treatment (Unison) – July 25, 2017.....	15
Figure 12: Real-Time Readings of the Gas System – July 25, 2017.....	16
Figure 13: CNG Storage Tanks.....	17
Figure 14: Aerial View of the Gas Cleaning Equipment	18
Figure 15: Monthly Low Carbon Fuel Standard Credit Transfer Activity Report for June 2017.	19
Figure 16: Ribbon Cutting Ceremony, December 2016	20
Figure 17: American Council of Engineering Companies Award Ceremony 2017 Poster	21
Figure 18: American Council of Engineering Companies National Award 2017	22
Figure 19: City of San Mateo’s Ford F-150 CNG Truck	24

LIST OF TABLES

	Page
Table 1: Task and Cost Summary.....	10
Table 2: Greenhouse Gas Emission Reductions – for Maximum Production	11
Table 3: Total Carbon Displacement – for Maximum Production.....	11
Table 4: Petroleum Displacement for Maximum Production	12
Table 5: Fuel Usage by Vehicle Identification	13

EXECUTIVE SUMMARY

The City of San Mateo is located on the San Francisco Peninsula, at the midpoint between San Francisco and Silicon Valley. The San Mateo City Council established sustainability as one of its top priorities and adopted an updated Climate Action Plan to achieve its goal of reducing Greenhouse Gas Emissions citywide. The City was looking to produce its own compressed natural gas from digester gas at the Wastewater Treatment Plant and using this fuel source for its fleet vehicles to reduce the transportation-related emissions within the community and in 2016, the City accomplished this goal.

California has a reliable and sustainable resource that is not being utilized to its full potential. This resource is digester gas that is produced as a byproduct of wastewater treatment in approximately 150 publicly owned wastewater treatment plants throughout the state. The feasibility of developing a compressed natural gas which would use the excess biogas produced from the anaerobic digestion process at the Wastewater Treatment Plant as a source gas to create the compressed natural gas was proposed to the California Energy Commission Program Opportunity Notice 13-609, Alternative and Renewable Fuel and Vehicle Technology Program for Pilot-Scale and Commercial-Scale Advanced Biofuels Production Facilities projects. At its November 17, 2014 business meeting, the California Energy Commission voted unanimously (4-0) to approve the agreement ARV-14-028 with the City of San Mateo for the \$4,900,000 project with a \$2,450,000 California Energy Commission grant for the digester gas to compressed natural gas project.

The project now sustainably and cost effectively produces low carbon vehicle fuel from the unused digester gas that is generated at the City of San Mateo's Wastewater Treatment Plant. To achieve this, the digester gas is being treated using a unique system to create biomethane that meets the Society of Automotive Engineers J1616 vehicle fuel standards at digester gas production rates commonly seen at Wastewater Treatment Plants. After treatment, the biomethane is being compressed and stored at a pressure suitable for rapid fueling of vehicles designed to operate on compressed natural gas. At the San Mateo Wastewater Treatment Plant, approximately 100 cubic feet per minute of wastewater generated digester gas is available to sustainably produce up to 500 gasoline gallon equivalents of biofuel every day, or approximately 160,000 diesel gallon equivalents of biofuel every year. Since the start of the fuel production, the City has only used 500 gasoline gallon equivalents for the first three months due to the limited available of compressed natural gas vehicles in its maintenance fleet. This amount will increase upon the delivery of seventeen newly purchased vehicles, expected to arrive in early 2018.

Chapter 1:

Project Narrative

1.1 Approach

In 2012 the City of San Mateo had been exploring the relocation of its corporation yard to the site adjacent to the Wastewater Treatment Plant at 2050 Detroit Drive, shown in Figure 1. When the challenge of vehicle fueling arose, one of the options presented was to investigate using the digester gas at the plant and converting the maintenance fleet to use compressed natural gas (CNG) in lieu of fossil fuels. The technology was new and creative, and the City pursued this project to achieve its Climate Action Plan goals and as a means to update its aging maintenance fleet.

Although the relocation of the corporation yard to be adjacent to the Wastewater Treatment Plant is now in the long-term master plan, the City continued with its immediate plans to use the digester gas for vehicle fuel and convert/purchase as many CNG vehicles in its fleet replacement plan as possible.

Figure 1: Wastewater Treatment Plant Site Plan



Photo Credit: Google Earth

1.1.1 Exploring Options for Digester Gas Use

Co-generation: Use of digester gas for energy had been explored by the City of San Mateo decades ago and in the mid-1990s, the City of San Mateo installed co-generation equipment at the wastewater treatment plant. The equipment lay dormant due to breakdowns and in 2011 the City commissioned a consultant to report on the cost benefits to activate the equipment. After almost 20 years, replacement parts were difficult to obtain, repair costs were expensive, and integrating the old co-generation equipment components with new technology was problematic.

Power Purchase Agreements: As a way to finance the repairs of the existing co-generation equipment, the City investigated power purchase agreement providers. The City's findings were that other cities and municipalities that had entered into power purchase agreements did not have successful outcomes. The terms and conditions of power purchase agreement financing were not agreeable to the City and this option was rejected.

Digester Gas: In a brainstorming session with Kennedy/Jenks Consultants, the idea to use the digester gas for vehicle fuels came about when outlining the City's goals for sustainability, the need to abolish the open-flame flare, finding a better use for digester gas, and deciding on a fuel for maintenance vehicles. This idea was explored and serendipitously, the California Energy Commission had just issued a Program Opportunity Notice for pilot scale advanced biofuels production facilities. Figures 2 and 3 show the wastewater treatment plant digester and the City of San Mateo's demolished open-flame flare.

Figure 2: Wastewater Treatment Plant Digester



Photo Credit: City of San Mateo

Figure 3: City of San Mateo's Open-Flame Flare (demolished)



Photo Credit: City of San Mateo, 2014

The project uses the renewable digester gas generated every day as a byproduct from the anaerobic digestion of wastewater generated biosolids to sustainably produce biomethane for use as vehicle fuel. The digester gas had been unused, so the City has taken advantage of the energy value in digester gas. The vehicle fuel displaces petroleum fuel and reduces the environmental consequences of transporting and combusting the petroleum fuel. The resulting compressed natural gas fuel creates fewer pollutants when combusted in a vehicle compared to the combustion of petroleum-based fuel in a vehicle.

1.3 Business Plan

The City of San Mateo proposed its project to the California Energy Commission in response to Program Opportunity Notice PON-13-609, "Pilot-Scale and Commercial-Scale Advanced Biofuels Production Facilities". The total project cost was \$4,900,000 of which \$2,450,000 was the grant award by the CEC. The City's match share was \$2,450,000 and funding for the City's match was from its unrestricted sewer fund balance.

1.3.1 Project Funding

The City is the owner of the project and provided its own match funds for the grant. The City continually finances projects like this as evidenced by its five-year Capital Improvement Program with over \$154 million in projects. The 2013 Comprehensive Annual Financial Report

showed that the Sewer Fund Enterprise had \$25.9M of cash and cash equivalents available for this project. Upon the signing of the grant agreement with the CEC in 2014, the City encumbered funds and created a separate project account to track all expenditures and CEC reimbursements.

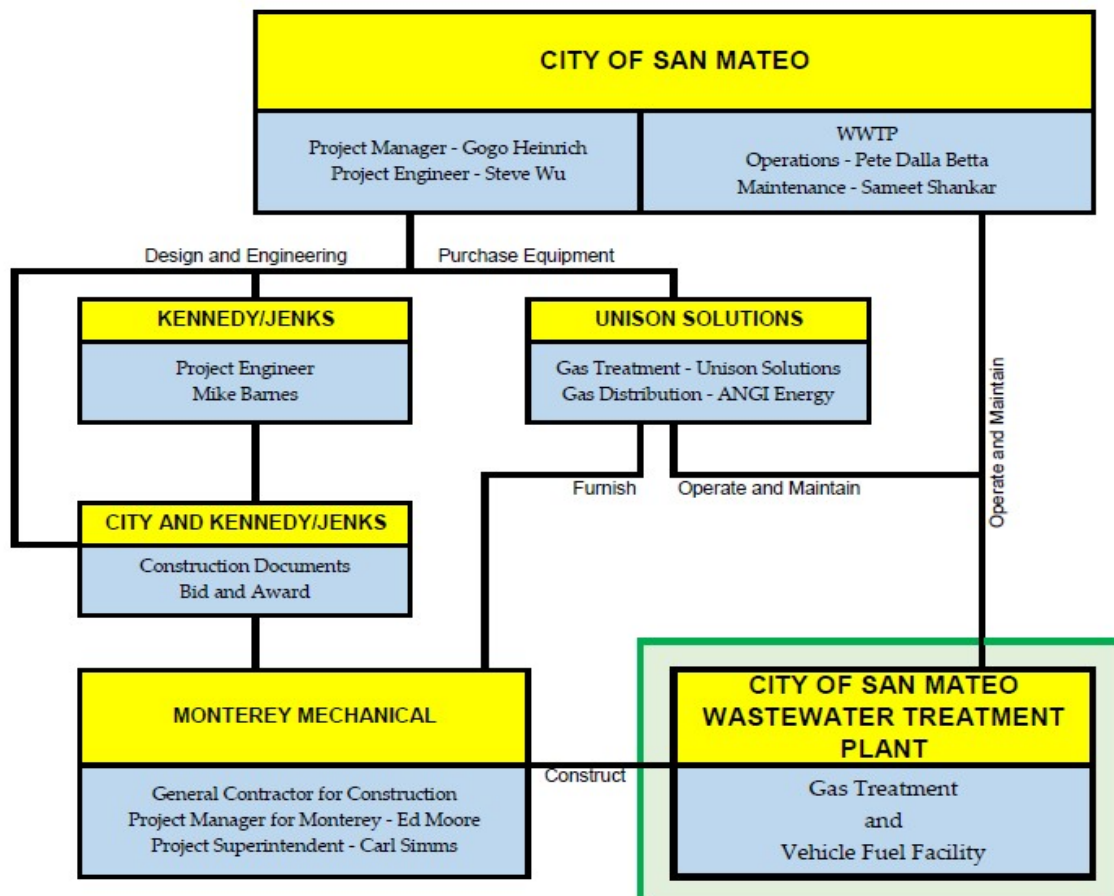
1.3.2 Revenue and Cost Savings

The City had included in its proposal to the CEC that selling of the carbon credits on the Carbon Exchange Market would be part of this project. Upon the completion of the gas production for vehicle fuel, the City awarded a contract to Blue Source, an independent broker, to sell its carbon credits under the federal program, Renewable Fuel Standard and the State of California program, Low Carbon Fuel Standard. The City is posed to submit its quarterly reports for the sale of its energy credits. When production is at its peak in 2-3 years, the City is looking to save \$720,000 per year for not having to purchase petroleum fuel and gaining \$90,000 in energy credits for a total of \$810,000 in revenue savings. Production is based on fuel usage and until the City obtains more CNG vehicles in its fleet, current production and the payback is minimal.

1.4 Project Implementation

In order to successfully deliver this project on time and within budget, the City of San Mateo assembled a qualified team of consultants, manufacturers, contractors, and staff, shown in Figure 4. Each of the participants were carefully selected and each of the City's contracts were created to address the uniqueness of the project.

Figure 4: City of San Mateo Organization Chart



The primary consultant that was engaged for the project was Kennedy/Jenks Consultants for design and engineering. Two minor consultants were Cleary Consultants for geotechnical work and Signet Testing, Inc. for site inspection and materials testing.

The City pre-purchased the gas cleaning and fuel system directly from the manufacturer, Unison Solutions. ANGI Energy, the fuel distribution manufacturer, was a subcontractor to Unison Solutions. Manufacturing of the equipment began in 2015 and delivery to the project site was in May 2016.

The City pre-qualified general contractors for the construction. Four contractors were prequalified, and the successful contractor was Monterey Mechanical. The construction contract was executed in November 2015 and the system was activated August 2016. Commissioning of the system was completed in March 2017 and the notice of completion of the project was filed June 2017. Figures 5 and 6 shows the project team at the groundbreaking ceremony and the completed skid with flare and unison equipment.

Figure 5: Groundbreaking Ceremony with Project Team



Figure 6: Completed Skid with Flare and Unison Equipment



Chapter 2:

Activity Report

2.1 Project Schedule

The total project duration from inception to completion was approximately three years. The following timeline highlights the milestone events for the project:

- 2013: City of San Mateo explores options for the use of digester gas and fleet fuel
- Mar 2014: City Submits its proposal to the CEC in response to PON-13-609
- Jul 2014: Notification of Award from the CEC
- Dec 2014: Contract with CEC executed
- Dec 2014: Contracts with consultants negotiated
- Jan 2015: Contract for equipment executed
- Jul 2015: Construction contractors pre-qualified
- Sep 2015: Construction contract out to bid
- Oct 2015: Bids received
- Nov 2015: Construction contract awarded
- Nov 2015: Construction Start
- May 2016: Gas cleaning and dispensing equipment delivered and installed
- July 2016: City purchases first CNG vehicle
- Aug 2016: Fueling system activated
- Sep 2016: Operations and maintenance training for City personnel
- 2016-17: Commissioning of the system
- Jun 2017: Notice of Completion filed
- Jun 2017: Start of quarterly reports for Renewable Identification Numbers and Low Carbon Fuel Standard carbon credits
- Jul 2017: 5-year maintenance agreements executed for the CNG equipment
- Jul 2017: City purchases seventeen more CNG vehicles
- Jul 2017: Final Report and Invoice submitted to CEC

2.2 Project Budget

The total project cost was \$4,900,000 which consisted of the CEC grant award amount of \$2,450,000 and the City's match amount of \$2,450,000. Table 1 shows the breakdown of tasks and cost allocations. There were no contractual changes required with the CEC for any of the tasks or allocations. The City of San Mateo was able to meet the requirements of the grant by pre-planning each of its separate contracts with itemizations to correspond with the task summaries.

Table 1: Task and Cost Summary

Task	Summary	Major Subcontractor Reimbursable Costs		Commission Reimbursable Totals	City of San Mateo Match Funding Totals	Grand Totals
		Unison Solutions	Monterey Mechanical			
1	Administration				\$80,972	\$80,972
2	Pre-Design, Design and Bidding				\$485,389	\$485,389
3	Procurement and Construction	\$330,000	\$2,120,000	\$2,450,000	\$1,860,487	\$4,310,847
4	Data Collection and Analysis				\$22,792	\$22,792
	Grand Totals			\$2,450,000	\$2,450,000	\$4,900,000

Source: City of San Mateo based on California Energy Commission Tasks

2.3 Data Collection and Analysis

The plan for data collection was incorporated into the construction documents using Supervisory Control and Data Acquisition software and controls. The software purchased by the City was “Wonderware”, and the software from the manufacturers, Unison Solutions and ANGI Energy, were integrated with the “Wonderware” program. The City is able to see and monitor the gas throughout the process – from output from the digesters to raw gas storage to clean gas processing to compression to fuel storage to distribution. In addition, the City has “Fuel Master” to register the amount of fuel being pumped into the vehicles.

2.3.1 Design Data

Tables 2, 3 and 4 re excerpts from the grant application, prepared by Kennedy/Jenks that explain and calculate the Greenhouse Gas Emission Reductions, Carbon Displacement, and Petroleum Displacement based on the maximum fuel production potential. (Note: The California reformulated gasoline blendstock for oxygenate blending (CARBOB) is a petroleum-derived liquid that is intended to be a product that will become California reformulated gasoline upon the addition of an oxygenate, such as ethanol.)

Table 2: Greenhouse Gas Emission Reductions – for Maximum Production

Description	Data	Source
Carbon Intensity of CARBOB	95.86 gCO ₂ e/MJ	ARB Table 6 LCFS CI lookup table
Carbon Intensity of Biogas	11.5 CO ₂ e/MJ	Per proposed ARB pathway

Note: Carbon intensity reduction using biogas in lieu of California Reformulated Gasoline Blendstock for Oxygenate Blending: 95.86 grams carbon dioxide per megajoule = 84.36 grams carbon dioxide per megajoule

Source: Kennedy/Jenks Consultants

Table 3: Total Carbon Displacement – for Maximum Production

Description	Data	Source
Volume of Biomethane	500 GGE/day	Technical Memorandum by Kennedy/Jenks
CARBOB	119.53 MJ/gal	Proposed Regulation to LCFS
Carbon Intensity of CARBOB	95.86 CO ₂ e /MJ	ARB Table 6 LCFS CI lookup table
Carbon Intensity of Biogas	11.5 CO ₂ /MJ	Per proposed ARB pathway
Project Life	25 years	Assumed time period (actual should be longer)

Note: 1. Energy of biomethane produced per day from digester gas: 500-gallon gas equivalent/day x 119.53 megajoules/gal = 59,765 megajoules/day 2. Carbon dioxide equivalent produced by use of California Reformulated Gasoline Blendstock for Oxygenate Blending fleet fuel: 59,765 megajoules/day x 95.86 grams carbon dioxide equivalent /megajoule x 1 metric ton/1E6 grams = 5.729 metric tons of Carbon dioxide equivalent per day 3. Carbon dioxide equivalent produced by use of biogas as CNG for vehicle fuel: 59,765 megajoules/day x 11.5 grams Carbon dioxide equivalent /megajoule x 1 metric ton/1E6 grams = 0.687 metric tons of Carbon dioxide equivalent per day 4. Carbon dioxide equivalent displaced per day: 0.687 metric tons Carbon dioxide equivalent (Biogas) – 5.729 MT Carbon dioxide equivalent (California Reformulated Gasoline Blendstock for Oxygenate Blending) = -5.042 metric tons of carbon dioxide/day 5. Carbon dioxide equivalent displaced per year: -5.042 metric tons of Carbon dioxide equivalent /day x 365 days/year = -1,840 metric tons of Carbon dioxide/year 6. Carbon dioxide equivalent displaced during the project life: -1,840 metric tons of Carbon dioxide equivalent /year x 25 years = -46,000 metric tons of Carbon dioxide total.

Source: Kennedy/Jenks Consultants

Table 4: Petroleum Displacement for Maximum Production

Description	Data	Source
Excess Volume of Digester Gas Produced by the Waste Water Treatment Plant	100 scfm	Technical Memorandum by Kennedy/Jenks
San Mateo Digester Gas Energy Density	~600 BTU/cf	Technical Memorandum by Kennedy/Jenks
Gallon Gas Energy Density	111,800 BTU/gas gal	CA Energy Commission Energy Almanac

Note: 1. Digester gas energy produced per day for the Project: 100 standard cubic feet per minute x 1,440 minutes per day x 600 British thermal units/standard cubic feet = 86,400,000 British thermal units/day 2. Gallons gas equivalent produced per day: 86,400,000 British thermal units/day / 111,800 British thermal units/gallon (gallon = 772 gasoline gallon equivalents/day) (Kennedy/Jenks used 500 gasoline gallon equivalents in the calculations based on a recommendation by Unison Solutions to conservatively account for the volume reduction by removing the carbon dioxide from the digester gas and for gas treatment losses.)

Source: Kennedy/Jenks Consultants

2.3.2 Data Collection

The following data is for a six-month period from January – June 2017. The City currently has only three CNG vehicles of the fifty fleet vehicles slated to be CNG. The City acquired a Chevy Impala Dual Fuel CNG/petroleum gas passenger vehicle in May 2016, shown in Figure 7, and two Ford F-150 CNG pick-up trucks, shown in Figure 8, in November 2016. Seventeen more vehicles (fourteen Ford F-350s and three Ford F-550s) have been purchased and the anticipated delivery is for early 2018. Although the system is designed for 500 gasoline gallon equivalents per day, the City has only been able to consume 690.47 gasoline gallon equivalents for the six-month period.

Figure 7: Chevy Impala with a Close-Up of the Dual Fuel Gas Nozzles



Photo Credit: City of San Mateo

Table 5: Fuel Usage by Vehicle Identification

Vehicle	Transactions	GGE Total	Odometer Reading	Miles per Gallon
Ford F-150 Truck 1	28	189.68	3,189	17 MPG
Ford F-150 Truck 2	35	332.83	5,564	17 MPG
Chevy Impala	39	167.96	7,703	N/A due to dual fuel
Total	102	690.47		

Total Carbon Displacement: 1. Energy of biomethane produced for this six-month period from digester gas: 690 gallons gasoline equivalent x 119.53 megajoules/gal = 82,476 megajoules 2. Carbon dioxide equivalent produced by use of California Reformulated Gasoline Blendstock for Oxygenate Blending fleet fuel: 82,476 megajoules x 95.86 grams Carbon dioxide equivalent /megajoules x 1 metric ton/1E6 grams = 7.906 metric tons of Carbon dioxide equivalent 3. Carbon dioxide equivalent produced by use of biogas as CNG for vehicle fuel: 82,476 megajoules x 11.5 grams Carbon dioxide equivalent/megajoules x 1 metric ton/1E6 grams = 0.948 metric tons of Carbon dioxide equivalent 4. Carbon dioxide equivalent displaced: 0.948 metric tons Carbon dioxide equivalent (Biogas) – 7.906 metric tons Carbon dioxide equivalent (California Reformulated Gasoline Blendstock for Oxygenate Blending) = -6,958 metric tons of Carbon dioxide

Source: City of San Mateo calculations based on Kennedy/Jenks Consultants formulas

Figure 8: Ford F-150 Fueling



Photo Credit: Carol Shaoffl, 2016

2.3.3 Data Collection on Equipment

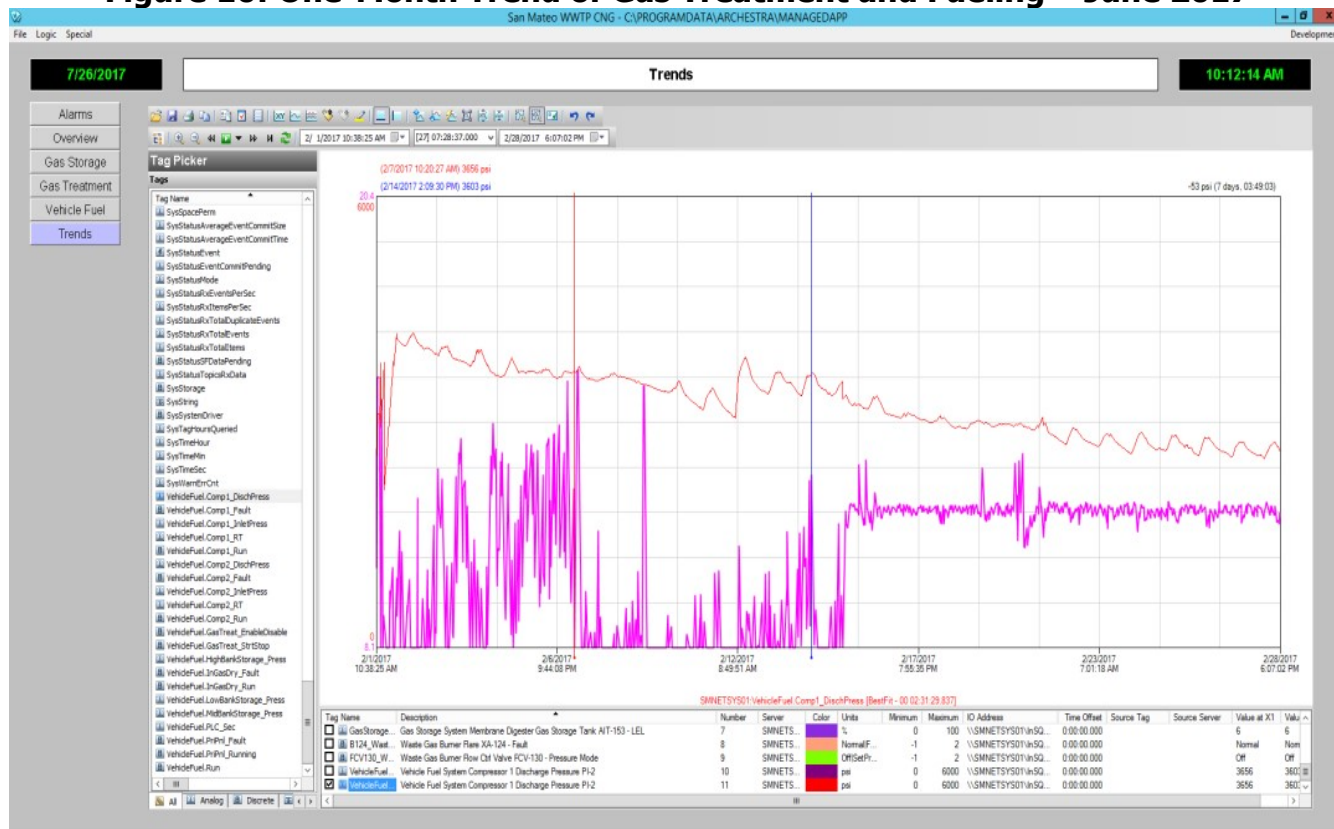
Figures 9 through 12 are computer screen shots of the City's program for the control and monitoring of the digester gas to CNG system. The City is able to see the output of digester gas, gas storage, gas treatment, gas flow to the dispensing area, compression, storage of CNG, and CNG fueling. The City is able to control the entire system from the master computer in the Wastewater Treatment Plant Supervisory Control and Data Acquisition room and in addition, control each piece of equipment at each of their local panels at the various site locations.

Figure 9: One-Month Trend of the Overall System – February 2017



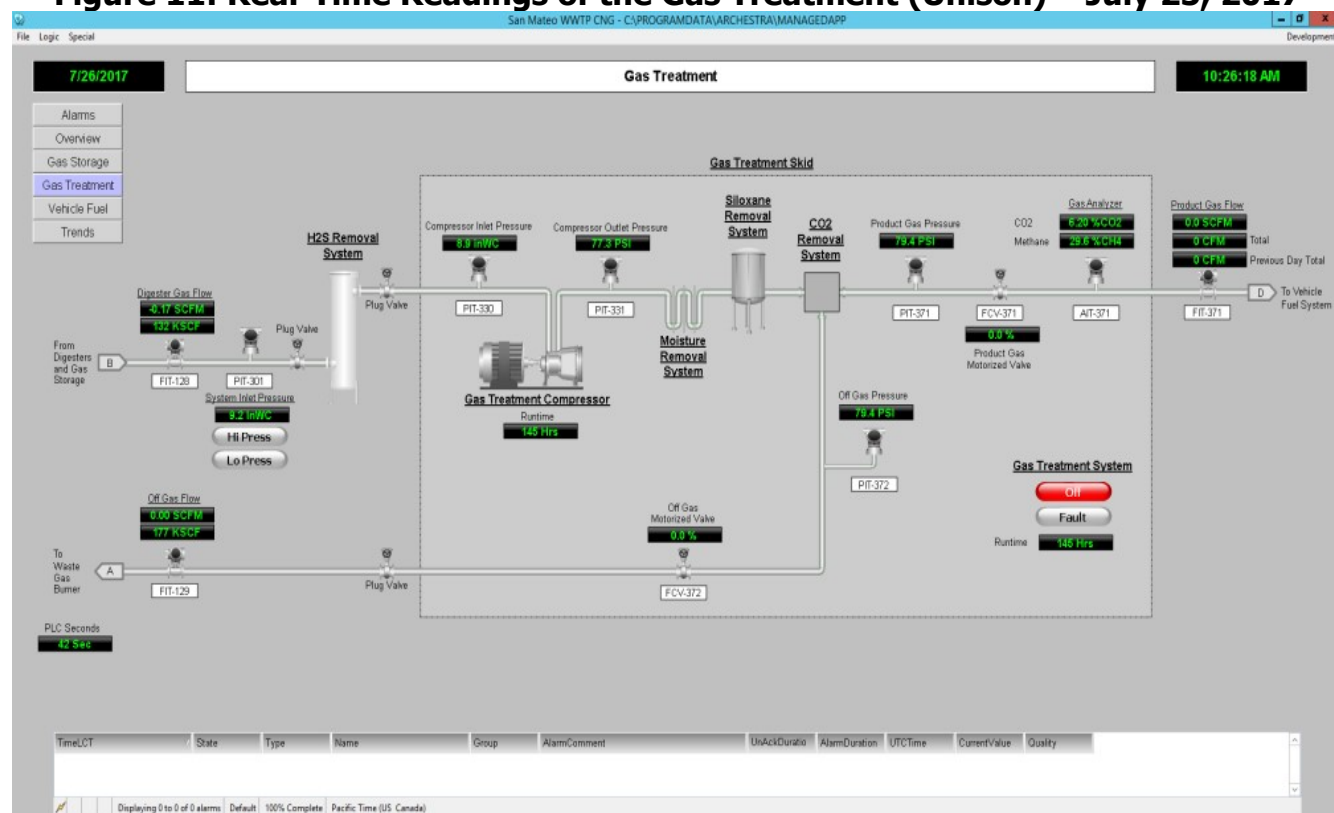
Source: City of San Mateo (Wonderware)

Figure 10: One-Month Trend of Gas Treatment and Fueling – June 2017



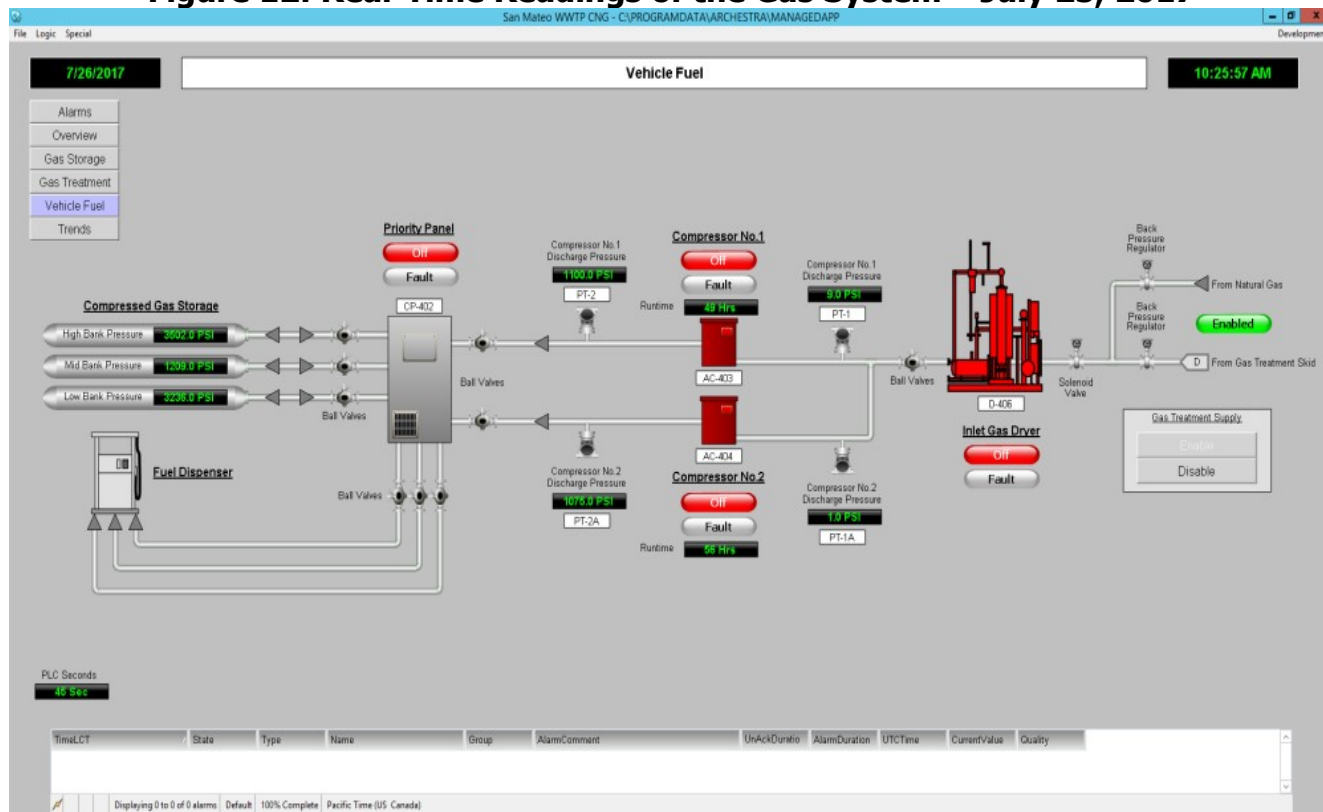
Note: At the mid-point of the month, the system was interrupted for routine maintenance.
Source: City of San Mateo (Wonderware).

Figure 11: Real-Time Readings of the Gas Treatment (Unison) – July 25, 2017



Source: City of San Mateo (Wonderware)

Figure 12: Real-Time Readings of the Gas System – July 25, 2017



Source: City of San Mateo (Wonderware)

One of the challenges the City encountered with this project was the integration of the new software with the existing software that controls the rest of the plant. The old software was installed in the early 1990's. The systems integrator was able to accomplish the networking between the old digester, old boiler, new gas cleaning equipment, new waste abatement device, new gas storage, shown in Figure 13, and new gas fueling system.

Figure 13: CNG Storage Tanks



Photo Credit: City of San Mateo

Chapter 3:

Project Assessment

3.1 Goals

3.1.1 Sustainability

With this project, the City met its goals for sustainability. The project approach was to use a new application of existing technology. The science for removing carbon and siloxanes had already been proven on high volume gas production – what our project proved was that this technology could be used on a small scale and that the renewable gas produced could be used as vehicle fuel. Our project's success can now be replicated at the other 150 public agencies in California that produce digester gas at their wastewater treatment plants. Figure 14 shows an aerial view of the gas cleaning equipment.

Figure 14: Aerial View of the Gas Cleaning Equipment



Photo Credit: City of San Mateo

3.1.2 Carbon Credits

In addition, with the completion of the project, the City enrolled in the Federal and State of California programs to sell its carbon credits. Blue Source, an independent broker, has been contracted by the City to sell its carbon credits under the Federal Environmental Protection Agency program, Renewable Fuel Standard and the State of California program, Low Carbon Fuel Standard. Quarterly reporting is in progress. Figure 15 is from the State of California Air Resources Board for the monthly Low Carbon Fuel Standard credit transfer activity in which the City of San Mateo now participates.

Figure 15: Monthly Low Carbon Fuel Standard Credit Transfer Activity Report for June 2017

Monthly LCFS Credit Transfer Activity Report for June 2017			
Posted on 7/11/2017			
Time Period	Transfers ¹ (number)	Total Volume ^{1 2} (credits-MTs)	Avg. Price ^{1 3} (\$ per Credit)
June 2017	120	765,000	\$77
Previous Three Months			
May 2017	69	366,000	\$80
April 2017	88	616,000	\$87
March 2017	101	591,000	\$93
Previous Three Quarters			
Q2 2017	277	1,747,000	\$81
Q1 2017	243	1,305,000	\$92
Q4 2016	307	2,193,000	\$93
Previous Years			
CY 2016	929	5,343,000	\$101
CY 2015	578	2,852,000	\$62
CY 2014	304	1,667,000	\$31

Price Range in June 2017 ^{1 3} = \$62 to \$105 per Credit

Entities Participation in Transfers through June 2017 :

- Number Only Selling = 76
- Number Only Buying = 24
- Number Selling and Buying = 56

Total Credits Transferred through June 2017 ^{2 4} = 13,898,000 MT

¹Includes transfers that were proposed and completed as well as those that were proposed and still pending buyer's confirmation in the LCFS Reporting Tool and Credit Bank & Transfer System (LRT-CBTS).

²Rounded to the nearest thousand.

³Some credit transfers were reported with a zero or near-zero price. The price shown excludes these transfers.

⁴Data excludes transfers that were proposed but were still pending buyer's confirmation in the LRT-CBTS.

Source: California Air Resources Board [Monthly Credit Reports](https://www.arb.ca.gov/fuels/lcfs/credit/lrtmonthlycreditreports.htm), available at <https://www.arb.ca.gov/fuels/lcfs/credit/lrtmonthlycreditreports.htm>

The City of San Mateo will be keeping track of the credits received in order to calculate the simple payback period for the project. The original payback period was anticipated to be 7.9 years to break even.

3.1.3 Construction

Construction was completed on time and within budget. The California Energy Commission has reimbursed the City \$2.45 million of the \$4.9 million. The project was fortunate that its core team remained intact from the start of the project to its completion – the California Energy Commission’s Agreement Manager; the City of San Mateo’s Project Manager; Kennedy/Jenks Consultants’ Engineer; and Monterey Mechanical’s Project Manager - as evidenced in the project’s ground-breaking photographs of 2015 and the ribbon-cutting ceremony photographs of 2016, shown in Figure 16. The consistency of the core team enabled the project to progress without interruptions or delays.

Figure 16: Ribbon Cutting Ceremony, December 2016



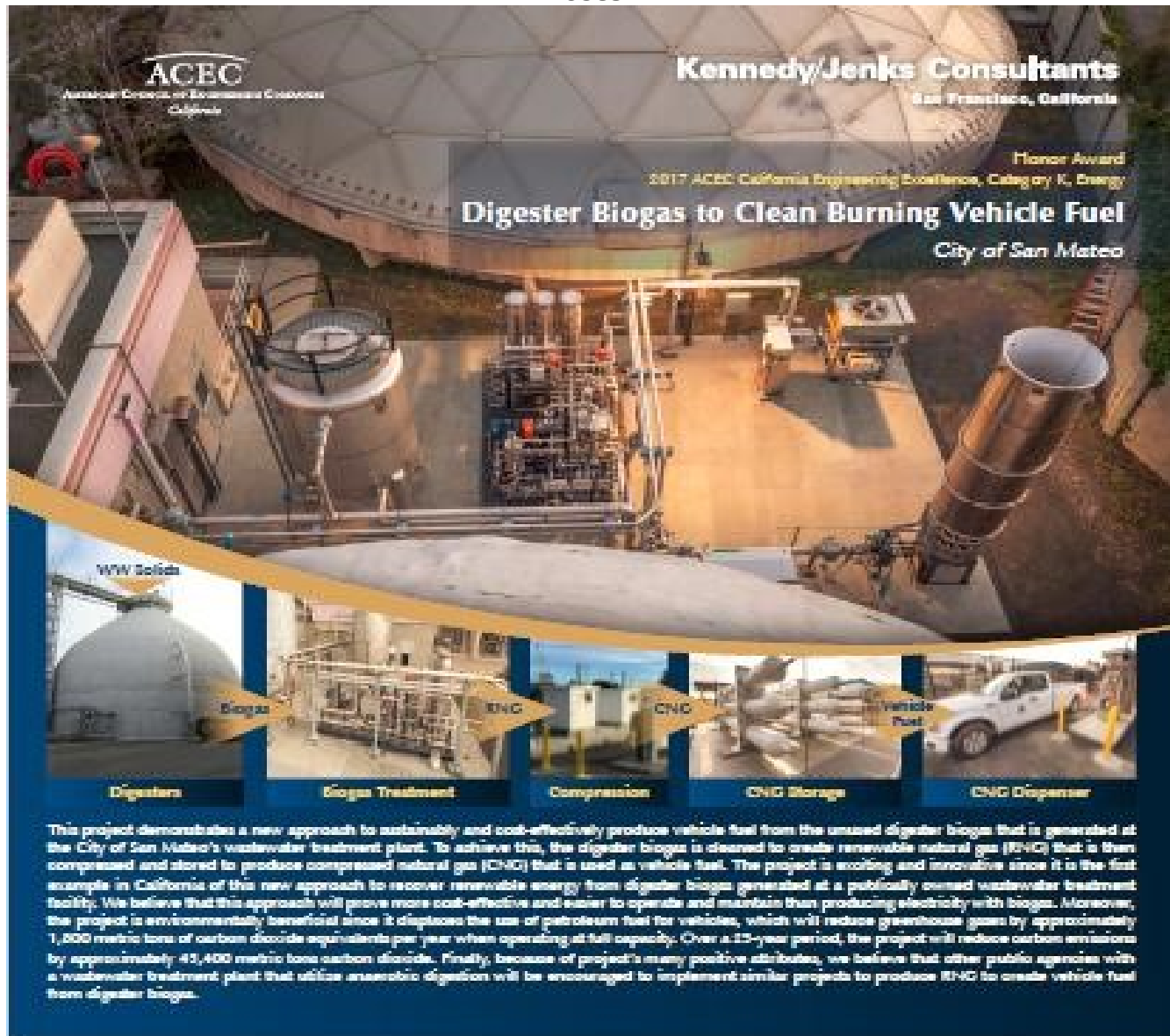
Photo Credit: Carol Shaoftl, 2016

3.2 Awards

3.2.1 American Council of Engineering Companies California Award

In February 2017 at the celebration in San Francisco of the American Council of Engineering Companies, shown in Figure 17, the City of San Mateo and the design engineers, Kennedy/Jenks Consultants, received the Honor Award for Engineering Excellence for this Digester Gas to Biomethane for Vehicle Fuel project.

Figure 17: American Council of Engineering Companies Award Ceremony 2017 Poster



Source: Kennedy/Jenks Consultants

3.2.2 American Council of Engineering Companies National Award

In April 2017 at the 50th anniversary celebration in Washington, D.C. of the National American Council of Engineering Companies, the City of San Mateo and the design engineers, Kennedy/Jenks Consultants, received the National Recognition Award for Engineering Excellence for this Digester Gas to Biomethane for Vehicle Fuel project, shown in Figure 18.

Figure 18: American Council of Engineering Companies National Award 2017



Photo Credit: Kennedy/Jenks Consultants

Chapter 4:

Recommendations for Further Projects

4.1 Project Challenges

4.1.1 Permits

The Bay Area Air Quality Management District is the governing agency that permits the City of San Mateo and Estero Municipal Improvement District's Wastewater Treatment Plant. For the permitting for construction and operations for the digester gas to CNG project, the Bay Area Air Quality Management District had categorized the Unison BioCNG gas cleaning equipment as a "source", primarily due to the fact that the Bay Area Air Quality Management District did not have an applicable definition for this new type of equipment. The Unison equipment used in this project does not fall under category S-191 since it does not produce gas and does not combust; and it does not produce or emit air pollutants per Bay Area Air Quality Management District Regulation 2, Rule 1, 2-1-221.¹ After nine months of correspondence, the Bay Area Air Quality Management District agreed to categorize the Unison BioCNG as not a source.

The City of San Mateo is in compliance with the permit to operate from the Bay Area Air Quality Management District for the entire system that includes a new gas storage unit from WesTech and a new flare from Varec. The entire system using digester gas meets the emissions factors designed in the permit for Nitrogen Dioxide and Carbon Monoxide.

Regarding the sulfur requirement of 200 parts per million by volume for the digester gas, hydrogen sulfide, the test results for October 4, 2016 were slightly higher than that specified. However, the operators at the plant increased the ferric chloride in the system and the latest reading for hydrogen sulfide is lower and in compliance. Laboratory reports are available to the Bay Area Air Quality Management District and the plant operators monitor the sulfur content of the gas once every calendar week.

Recommendation: Ensure that the Bay Area Air Quality Management District and other Air Districts in the State of California apply the same definitions and regulations to all other future projects utilizing new technologically advanced gas cleaning equipment for their digester gas.

4.1.2 Acquisition of CNG Vehicles

When the project was first proposed to the California Energy Commission in 2014, new Honda Civics were available with CNG gas tanks and it appeared that other new light and heavy-duty trucks were also available. In 2014 there were also a number of certified technicians in California to retrofit petroleum vehicles to CNG. When the project was in construction, the City began its purchasing process for new CNG vehicles, only to find that Honda stopped its production of CNG Civics, and a number of certified technicians for the retrofit of vehicles in the State of California allowed their certifications to expire due to a combination of the lack of market need and the burden of certification. Figure 19 shows the City of San Mateo's Ford F-150 CNG Truck.

¹ "Complex Permitting Handbook for Bay Area Air Quality Management District New Source Review Permitting", September 2016, Bay Area Air Quality Management District

The City is finding that the costs of the vehicles has increased due to the lack of competition amongst the dealers. The purchase of seventeen vehicles produced some cost savings, but only because of the quantity in the order. The lack of availability of vehicles and the price increases will need to be considered in future project financial plans.

Recommendation: Provide a current list of CNG vehicles available for purchase. Provide a current list of all California Environmental Protection Agency Air Resources Board certified mechanics who can modify vehicles to CNG.

Figure 19: City of San Mateo's Ford F-150 CNG Truck



Photo Credit: City of San Mateo

GLOSSARY

CALIFORNIA ENERGY COMMISSION (CEC)—The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The CEC's five major areas of responsibilities are:

1. Forecasting future statewide energy needs.
2. Licensing power plants sufficient to meet those needs.
3. Promoting energy conservation and efficiency measures.
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels.
5. Planning for and directing state response to energy emergencies.

Funding for the CEC's activities comes from the Energy Resources Program Account, Federal Petroleum Violation Escrow Account, and other sources.

CALIFORNIA REFORMULATED GASOLINE BLENDSTOCK FOR OXYGENATE BLENDING (CARBOB)—A petroleum-derived liquid that is intended to be a product that will become California reformulated gasoline upon the addition of an oxygenate, such as ethanol.

COMPRESSED NATURAL GAS (CNG)—Natural gas that has been compressed under high pressure, typically between 2,000 and 3,600 pounds per square inch, held in a container. The gas expands when released for use as a fuel.